

Regenerating High Forest on Singapore Island

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Introduction

NOTES ON SECONDARY or subseral vegetation on Singapore Island were given in a previous paper (Gilliland, 1958). Most of the island is covered with such vegetation today and the causes of this are made patent from the history of gambier, pepper and coffee cultivation and timber and fire-wood exploitation as recorded by Burkill (1935, p. 2201). The principal surviving relic of primary high forest has long been preserved first as a forest reserve by the Forest Department of the Straits Settlements, and later as a nature reserve by the Nature Reserves Board, Singapore. This relic of some 152 acres covers the upper slopes of the island's highest hill, Bukit Timah, and is the type-locality for a remarkably large number of species. The possibility of the existence elsewhere on the island of small relics of primary high forest was made manifest from a study of aerial photographs. A large area jointly maintained as a Nature Reserve by the City Council and the Nature Reserves Board comprises the catchment area of the three principal reservoirs of the City's water supply. The southernmost of these is the MacRitchie Reservoir and the photographs suggested that the vegetation along its southern shore would warrant study. Such study reveals the presence of a forest of Dipterocarp dominated type which has not been so exploited as to alter radically its character. This paper discusses the results of the application of a line transect sampling technique to this forest.

History

Enquiry from the City Water Engineer reveals that this Reservoir first came under the control of the City Council Water Department in 1857.

The Office of the Commissioner of Lands, Singapore, records that in the same year the piece of land on which this forest now stands was granted to Mr. Sim Wye Tye (Indenture No. 19) and Mr. Tan Ah Pok (Indenture No. 84).

Further sales of this land, of the first portion in 1876 and of the second portion in 1858, to further owners are recorded but in 1890 the Municipal Commissioners acquired all the land in this area. The acquired land was surrendered to Government and on

2nd June, 1906 was re-issued with new title to the Municipal Commissioners.

In 1910 the bridle path, which currently traverses the forest from west to east, was cut and in 1933 the road "Lornie Road" which, today, forms the southern boundary of "MacRitchie Reservoir Jungle" was constructed.

It is reasonable to conclude, especially in light of the more recent building of the paths and roads, that such occupation of the land as did occur was not wholly destructive of the then-existing vegetation. However, the existence of an old road crossing the reservoir from north to south, recently revealed during a drought period, indicates that communications, even if of different pattern from the present, did exist previously.

Principal Trees

There are many large trees in the area and specimens of the following with a diameter at breast height, or above buttress, of 2 feet or more (76 in. girth) were noted.

- | | |
|-------------------------------------|--|
| 1. <i>Adina rubescens</i> | 20. <i>Ficus consociata</i> v. <i>murtonii</i> |
| 2. <i>Alstonia angustifolia</i> | 21. <i>Gordonia singaporeana</i> |
| 3. <i>Anisoptera megistocarpa</i> | 22. <i>Heritiera simplicifolia</i> |
| 4. <i>Aquilaria malaccensis</i> | 23. <i>Irvingia malayana</i> |
| 5. <i>Artocarpus scortechinii</i> | 24. <i>Koompassia malaccensis</i> |
| 6. <i>Artocarpus lanceifolius</i> | 25. <i>Melanorrhoea woodsiana</i> |
| 7. <i>Artocarpus anisophylla</i> | 26. <i>Nephelium lappaceum</i> |
| 8. <i>Artocarpus rigidus</i> | 27. <i>Palaquium rostratum</i> |
| 9. <i>Calophyllum floribunda</i> | 28. <i>Palaquium obovatum</i> |
| 10. <i>Camptosperma auriculata</i> | 29. <i>Pygeum polystachyum</i> |
| 11. <i>Castanopsis hullettii</i> | 30. <i>Quercus brevistyla</i> |
| 12. <i>Cinnamomum iners</i> | 31. <i>Santiria laevigata</i> |
| 13. <i>Cryptocarya griffithiana</i> | 32. <i>Santiria tomentosa</i> |
| 14. <i>Dipterocarpus hasseltii</i> | 33. <i>Santiria griffithii</i> |
| 15. <i>Dipterocarpus apterus</i> | 34. <i>Shorea ovalis</i> |
| 16. <i>Dipterocarpus kunstleri</i> | 35. <i>Shorea glauca</i> |
| 17. <i>Dyera costulata</i> | 36. <i>Shorea paucifolia</i> |
| 18. <i>Dysoxylum mollissimum</i> | 37. <i>Vitex pubescens</i> |
| 19. <i>Fagraea fragrans</i> | |

It seems reasonable to conclude on the basis of such mean annual increment data as are available (Edwards, 1930) that none of these trees is likely to be older than 100 years. This finding agrees with the supposition that following the original alienation of the land little more than the extraction of standing timber was done—the present trees would then represent the successful subsequent growth of existing regeneration (Richards, 1952).

Sampling Method

To contrast this with the secondary forest already examined (Gilliland, 1958) it was decided to make a similar line transect

sample. The sample consists of a belt or transect 1,000 feet long and 6 feet wide and is obtained as follows:—

- (a) It is divided into 10 sub-samples each 100 feet long, each sub-sample taken at random.
- (b) Each sub-sample is obtained by laying down a surveyor's 100 foot chain. Thereupon the No. 1 of the pair of observers prepares four 3 feet wands which are spaced and respaced along the chain to demarcate convenient portions 6 feet wide. No. 2 of the pair of observers acts as amanuensis recording data, and the team works its way along the chain.
- (c) All woody stems are measured with a diameter tape so that they may be recorded in the size categories 0–1; 1–3; 3–5; 5–7; and > 7 inches.
- (d) A specimen of any seedling, sapling, or tree which cannot immediately be identified is numbered and collected for identification.

It is wise to make two practice 100 foot samples before commencing on the serious record in order to become familiar with the principal plants present in all their stages.

A sub-sample takes between 1 and 2 hours to record in the field. As soon as the data for a particular sub-sample have been obtained work on the “unknowns” begins. This may occupy a further week. Not till this is complete does work on the second sub-sample begin. Identification was greatly assisted by the knowledge and help of 'Che Ahmad bin Hassan and Tuan Haji Mohammed Nor bin Mohd. Ghous both of whom had served on the Botanic Gardens staff for over 40 years. Much time and patience is clearly required to complete a sample.

As noted above 10 sub-samples were used for the collection of the data. The question then arose as to whether or not one can generalise from the 10 sub-samples and draw conclusions about the total area from which the sub-samples were taken.

The first step was to determine whether or not these 10 sub-samples could be treated as a random group of samples from the general area. The intention was to test this by the *analysis of variance* technique. One of the requirements of the analysis of variance technique is that the variability should be similar from one sub-sample to the next. Putting it another way the 10 sub-samples should be homogenous with respect to the variability of the frequencies. This test for homogeneity was carried out by means of Bartlett's test and the samples proved *not* to be homogeneous by this test. The results are presented in table I.

TABLE I

MEANS AND VARIANCES OF THE FREQUENCIES OF THE 205 SPECIES IN THE 10 SUB-SAMPLES.

<i>Sub-sample No.</i>	<i>Mean Frequency</i>	<i>Variance of Frequencies</i>
	1.33	21.90
	1.53	19.45
3	2.43	52.98
4	2.42	41.70
5	2.63	79.87
6	2.74	49.16
7	2.80	67.40
8	2.05	30.81
9	1.82	17.86
10	2.43	44.10

Bartlett's Test: $X^2 = 236.64$ $P < .001$

The result of Bartlett's test therefore made the application of the analysis of variance "F—test" questionable. The decision was made then to test all the possible differences between the means of the sub-samples by the "t"—test of significance. Forty-five t-tests then had to be carried out. With the 0.05 level of significance as the critical value, if the hypothesis of random sampling is tenable, there should be no more than 3 differences large enough to be judged significant at the 0.05 level and beyond. When the 45 tests of significance were carried out 3 differences barely reached the .05 level of significance. These differences were between sub-sample 1 and sub-sample 6, sub-sample 1 and sub-sample 7, and between sub-sample 2 and sub-sample 6. No difference reached the 0.01 level. Thus with respect to the means of the 10 sub-samples one can retain the hypothesis that they are random samples from the same population.

It is interesting to note that in spite of the violation of the homogeneity of variance test and in spite of the distributions being non-normal the overall F-test shown in table II clearly supports the conclusion above that the means can be assumed to be drawn from the same population.

TABLE II

ANALYSIS OF VARIANCE TEST OF RANDOM SAMPLING.

	<i>Sums of Squares</i>	<i>d.f</i>	<i>Variance Estimate</i>
Between sub-samples	.. 485.95	9	53.99
Within sub-samples	.. 86,742.58	2,040	42.52
F=	1.27		
P>	.05		

The data were then rearranged from the index cards and each of the 205 species was classified according to its "B" (belongingness) value where the value of "B" is the number of sub-samples in which that species occurred; thus "B" = 7 means the species has been recorded in 7 out of 10 sub-samples and "B" = 2 means the species has been found in 2 sub-samples only. A "B" value was determined for each species.

It is clear from the above definition of "B" that one would expect a positive correlation between the frequency of a plant and its "B" value, but there is no reason to expect this relationship either to be linear or perfect. Table III shows the scatter diagram of the two-way plot of "B" values and frequencies. The positive relationship and its non-linearity can readily be seen from the table.

TABLE III
SCATTER DIAGRAM OF "B" VALUES AND FREQUENCIES.
"B" VALUES

"frequencies"	1	2	3	4	5	6	7	8	9	10
200-299 ..	..	..	..	..	..	..	..	..	..	2
180-199 ..	..	..	..	..	..	..	..	..	2	..
160-179 ..	..	..	..	..	..	..	2	..	..	1
140-159 ..	..	..	..	..	..	..	2	..	1	..
120-139 ..	..	..	..	..	..	..	..	1	..	1
100-119 ..	..	..	..	..	..	..	..	..	..	3
90-99 ..	..	..	..	..	..	..	..	..	..	1
80-89 ..	..	..	..	..	..	..	..	..	..	2
70-79 ..	..	..	..	..	..	..	1	..	..	..
60-69 ..	..	..	..	..	..	..	1	..	..	..
50-59 ..	..	..	..	..	1	..	1	..	1	1
40-49 ..	..	..	..	..	..	2	2	1	..	..
35-39 ..	..	..	..	..	..	1	1	1	1	..
30-34 ..	..	..	..	..	..	..	..	..	..	..
25-29 ..	..	1	..	..	..	2	1	3	1	..
20-24 ..	..	..	..	..	4	3	2	..	..	..
15-19 ..	..	1	2	1	2	1	3	2	..	..
10-14 ..	..	..	3	1	4	4	2	1	..	..
9 ..	..	1	2	3	..	..	..	..	..	..
8 ..	..	..	2	1	..	1	1	..	..	..
7 ..	..	..	..	..	3	..	..	..	..	..
6 ..	..	..	2	1	1	..	..	..	..	..
5 ..	..	3	3	..	..	..	..	..	..	..
4 ..	1	2	4	..	..	..	..	..	..	..
3 ..	2	2	7	..	..	..	..	..	..	..
2 ..	14	13	..	..	..	..	..	..	..	..
1 ..	58	..	..	..	..	..	..	..	..	..
Tota's ..	75	23	25	7	16	14	19	9	6	11

(Note:—The grouping interval of the *frequency* variable has not been kept constant in order to show the non-linearity more clearly).

A priori considerations had led to the tentative conclusion that plants having a "B" value of 7 and higher were more likely to "belong" to that particular area than those with "B" values of 6 and lower. This hypothesis suggested dichotomizing the "B" variable and summarizing the relationship between *frequencies* and B values by means of a statistic such as the biserial product moment r . The formula for r is as follows:—

$$r = \sqrt{\frac{p}{q}} \left(\frac{M_H - M_T}{\sigma_T} \right)$$

where p = proportion of plants in the group with the higher B values

$$q = 1 - p$$

M_H = Mean frequency of the higher group

M_T = Mean frequency of the total sample of plants

σ_T = Standard deviation of the frequencies of the total sample.

An alternative formula for the biserial product moment correlation coefficient may be written as follows:—

$$r = \left(\frac{M_H - M_L}{\sigma_T} \right) \sqrt{pq}$$

where the symbols are defined as they were for the formula above and M_L equals the mean frequency of the group with the lower B-values. From the alternative formula it can be seen that the magnitude of the r is a function of the difference between the mean frequencies of the higher and lower groups. The use of the biserial product moment r has the advantage over the simple difference in that it takes into account the variability in the total group and the proportions in the two groups thus making possible comparisons from one investigation to another.

Even though the original hypothesis had suggested dichotomizing at $B=7$ and higher to obtain the higher group, it was decided to investigate the correlation at other possible points of dichotomy. The results are presented in table IV.

TABLE IV.

BISERIAL PRODUCT MOMENT CORRELATION AT DIFFERENT POINTS OF DICHOTOMY.

<i>Pt. of dichotomy</i>	<i>p.</i>	$M_H - M_T$	<i>r</i>
B=10	.0537	110.66	.60
B= 9 and 10..	.0829	100.47	.68
B= 8 and higher	.1268	71.20	.61
B= 7 and higher	.2195	56.71	.68
B= 6 and higher	.2878	43.24	.62
B= 5 and higher	.3659	32.59	.56
B= 4 and higher	.4000	28.77	.53

(Note:—Computations based on ungrouped data of table III).

The highest correlation viz. .68 is obtained with the dichotomies at B=9 and B=7. It should be obvious that the B=7 is a more desirable point of dichotomy.

The biserial product moment *r* as a summary statistic of the relationship between *frequency* and B value was examined for data from two earlier investigations in order to check whether or not the dichotomy at B=7 and higher would have been best for those data. In one of the earlier investigations (Gard. Bull. XVII 1958) the *r*'s for dichotomies at B=8, B=7, B=6, and B=5 were .49, .46, .45 and .39 respectively and in the second earlier investigation, the *r*'s for dichotomies at B=8, B=7, B=6 and B=5 were .61, .56, .49 and .41 respectively. (Sarawak cf. Trans. Bot. Soc. Edn. 1959). These results would lead one to retain the B=7 dichotomy since they do not conflict with the present study and since the B=7 dichotomy was chosen on the basis of other considerations prior to the statistical analysis.

Having established the dichotomy at B=7 the 205 species can now be separated into two groups:—

Group I those species with B=7 and higher.

Group II „ „ „ B=6 and lower.

This dichotomy resulted in 45 species being classified in group I and 160 in group II. The species in group I clearly represent the important plants of the present community; the group II species are those occurring less regularly and in smaller frequencies.

The 45 species in group I were further classified into A. Trees, B. Shrubs, C. Lianes, and D. Herbs.

The 160 species in group II were classified into Group G—22 species and Group H— 138 species. This further classification is presented below.

The main defect in the description of the community is the absence of quantitative data on epiphytes.

Since the data for the 10 sub-samples were combined for each of the six groups A, B, C, D, G and H, the question arises as to whether or not each sub-sample can be considered with respect to the group under discussion as random sub-samples from the total sample.

The results are summarised in Table V.

Results

TABLE V.

		No. of specs.	No. of plts.	% of total plts.
"B" = 7 or more	Group A. Trees ..	16	1,459	32.0
	,, B. Woody Plants ..	17	1,096	24.1
	,, C. Lianes ..	11	987	21.7
	,, D. Herbs ..	1	8	0.1
"B" = 6 or less	Group G.	22	273	6.0
	,, H.	138	723	15.9
		205	4,546	99.8

Bartlett's test for homogeneity of variance again showed a lack of homogeneity in the five groups tested (the D group had to be omitted because of only one species in it). Thus the application of the F-test for an overall test of differences was again questionable. The forty-five mean differences were therefore tested for significance in each of the five groups. A summary of results is given in table VI. With the chance expectancy of no more than 3 "significant" differences among 45 at the .05 level and beyond, the results showed no differences at the .05 level or beyond for the A, B and C groups. For the G and H groups there were 4 and 6 differences respectively which were beyond the .05 level although none of them reached the .01-level. When the A, B, C and D Groups are combined, only 2 differences reach the .05 level; the combination of G and H groups yields 4 differences at the .05 level and 2 beyond the .01 level.

These results suggest that the species in the A, B, C and D groups differ from those in the G and H groups in this forest area. Thus, all of the statistical analyses confirm the conclusion that the species in the A, B, C and D groups "belong" to this forest area while those in the G and H groups do not.

TABLE VI.

Means and Variances of the frequencies of the 10 sub-samples for each of the GROUPS.

Sub-sample No.	GROUP													
	A		B		C		A+B+C+D		G		H		G+H	
	M	V	M	V	M	V	M	V	M	V	M	V	M	V
1	4.81	100.30	4.24	78.57	6.27	82.62	4.89	82.37	.45	.93	.30	.67	.325	.70
2	5.38	71.72	5.35	82.99	4.18	49.96	4.98	66.61	.45	1.21	.57	2.36	.556	2.20
3	11.88	236.25	5.29	62.22	11.09	289.69	8.93	180.25	.73	2.02	.58	2.89	.600	2.76
4	11.00	184.66	7.18	114.78	6.73	113.42	8.29	135.44	1.59	3.87	.64	3.37	.769	3.52
5	11.44	203.33	4.82	25.65	17.82	789.36	10.27	286.20	.82	5.01	.43	1.71	.488	2.15
6	11.31	206.10	6.53	91.01	7.82	98.96	8.42	131.61	1.00	13.14	1.16	15.30	1.14	14.92
7	8.50	104.00	14.88	460.74	6.64	39.05	10.27	226.93	2.55	16.55	.41	.84	.700	3.46
8	6.94	61.93	6.18	38.40	11.45	237.47	7.62	94.69	1.59	8.63	.31	.86	.488	2.08
9	7.44	53.73	3.76	15.94	7.91	98.69	6.02	50.70	1.77	9.99	.46	1.10	.638	2.48
10	12.50	199.07	6.24	56.32	9.82	177.76	9.20	138.12	1.45	4.93	.38	1.13	.531	1.76

Bartlett's Test... 19.2*

No. of species 16

67.6**

38.3**

37.2**

76.2**

706*

507**

No. of Differences between Means at .05 level and beyond .. 0

0

0

2*

4*

6*

4*+2**

*.01 < P < .05 **P < .01

Group A, comprising those species whose mature individuals reach to canopy height, is listed in Table VII. Clearly dominance in this group could refer to the *Shorea* spp. but when Table XIII with a total of 513 Dipterocarps is taken into account the "family dominance" of the Dipterocarpaceae seems clear. It should be noted however that members of the Guttiferae (which includes *Garcinia* and *Calophyllum*) total 682 plants. Most of these (677) however fall into the first size class, the seedlings with a stem diameter less than one inch, and furthermore trees of these genera rarely reach to the height of the canopy.

TABLE VII.
GROUP A.—TREES

Species	DIAMETER CLASSES					Total	"B" Value
	0-1	1-3	3-5	5-7	Over 7		
<i>Shorea macroptera</i> ..	178	..	..	..	3	181	9
<i>Shorea parvifolia</i> ..	172	..	..	..	1	173	7
<i>Shorea parviflora</i> ..	83	..	..	..	..	83	10
<i>Gironniera nervosa</i> ..	26	2	..	..	1	29	8
<i>Pygeum polystachyum</i>	124	3	..	1	..	128	10
<i>Onchosperma horridum</i>	99	4	2	6	..	111	10
<i>Garcinia griffithii</i> ..	132	3	2	..	..	137	8
<i>Santiria tomentosa</i> ..	34	2	4	..	..	40	7
<i>Dacryodes laxa</i> ..	24	1	1	..	..	26	8
<i>Quercus</i> sp. ..	22	2	1	..	..	25	8
<i>Lindera lucida</i> ..	14	..	1	..	..	15	8
<i>Dialium</i> sp. ..	177	1	..	..	..	178	7
<i>Coelodepas wallichianum</i>	158	3	..	..	..	161	10
<i>Melanorrhoea woodsiana</i>	106	4	..	..	..	110	10
<i>Gomphandra affinis</i> ..	47	1	..	..	..	48	7
<i>Elaterospermum tapos</i>	14	..	..	..	..	14	7
	1,420	26	11	7	5	1,459	..

Group B, Table VIII lists the shrubs and small trees which do not reach to canopy height or potential trees which have not yet exceeded sapling size. The shrubs characteristic of this community are clearly *Agrostistachys sessilifolia* and *Aprosa benthamiana* (both Euphorbiaceae).

TABLE VIII.

GROUP B.—SMALL TREES AND SHRUBS

Species	DIAMETER CLASSES					Total	"B" Value
	0-1	1-3	3-5	5-7	Over 7		
<i>Agrostistachys sessilifolia</i>	234	4	..	..	..	238	10
<i>Aporosa benthamiana</i>	45	9	..	..	..	54	10
<i>Cryptocarya griffithiana</i>	16	2	..	..	..	18	7
<i>Calophyllum pulcherrimum</i>	182	..	..	..	..	182	9
<i>Calophyllum inophylloide</i> var. <i>singaporensis</i>	149	..	..	..	..	149	9
<i>Calophyllum ferrugineum</i>	95	..	..	..	..	95	10
<i>Xanthophyllum discolor</i>	77	..	..	..	..	77	7
<i>Garcinia parvifolia</i> ..	52	..	..	..	..	52	9
<i>Garcinia eugenifolia</i> ..	35	..	..	..	..	35	8
<i>Scorodocarpus borneensis</i>	45	..	..	..	..	45	8
<i>Anisophyllea disticha</i>	36	..	..	..	..	36	9
<i>Clerodendron disparifolium</i>	27	..	..	..	..	27	7
<i>Myristica crassa</i> ..	24	..	..	..	..	24	7
<i>Acronychia porteri</i> ..	20	..	..	..	..	20	7
<i>Eugenia longiflora</i> ..	19	..	..	..	..	19	8
<i>Eugenia</i> sp.	12	..	..	..	..	12	8
<i>Aquilaria malaccensis</i>	13	..	..	..	..	13	7
	1,081	15	..	..	..	1,096	

Group C, Table IX gives the lianes present and the prominence of the family Connaraceae is noteworthy and is indicated by * in the table.

TABLE IX.

GROUP C.—LIANES AND CLIMBERS

Species	DIAMETER CLASSES					Total	"B" Value
	0-1	1-3	3-5	5-7	Over 7		
Willughbeia coriacea ..	285	..	..	..	..	285	10
Rourea sp.* ..	150	..	..	..	..	150	7
Rourea fulgens* ..	85	..	..	..	..	85	10
Agelaia sp.* ..	147	..	..	..	..	147	7
Psychotria ovata ..	109	..	..	..	..	109	10
Connarus sp.* ..	64	1	..	..	..	65	7
Fibraurea chloroleuca	51	..	..	..	..	51	7
Piper caninum ..	35	..	..	..	..	35	7
Tetracera indica ..	26	..	..	..	..	26	9
Ventilago sp. ..	19	..	..	..	..	19	7
Vitis macrostachya ..	15	..	..	..	..	15	7
	986	1	..	..	..	987	

Group D, Table X the true herbaceous plants—i.e. those which are not seedlings or saplings of trees, shrubs or lianes, are represented here solely by the fern *Tectaria singaporeana*.

TABLE X.

GROUP D.—HERBS.

Species	Total	"B" Value
Tectaria singaporeana ..	8	7

Group G, is listed in Table XI. This group is distinguished from the remainder of those with "B" = 6 or less by the fact that some of them have a stem diameter greater than 1" at breast height. At least the first 8 are large enough to be reproducing themselves and the comparative paucity of their seedlings is noteworthy.

TABLE XI.
GROUP G.

Species	DIAMETER CLASSES					Total	B
	0-1	1-3	3-5	5-7	Over 7		
<i>Anisoptera megistocarpa</i>	8	..	..	1	1	10	5
<i>Dialium maingayi</i> ..	2	..	..	..	1	3	1
<i>Dipterocarpus verrucosus</i>	1	..	..	..	1	2	1
<i>Dipterocarpus hasseltii</i>	..	..	..	..	1	1	1
<i>Litsea grandis</i> ..	12	3	1	..	..	16	5
<i>Macaranga lowii</i> ..	8	..	1	..	..	9	3
<i>Timonius wallichianus</i>	4	..	1	..	..	5	3
<i>Diospyros lancifolia</i> ..	2	..	1	..	..	3	3
<i>Eugenia</i> sp. 4. ..	41	2	..	..	..	43	6
<i>Litsea</i> sp.	40	1	..	..	..	41	6
<i>Polyalthia angustissima</i>	24	3	..	..	..	27	6
<i>Aglaia glabriflora</i> ..	23	1	..	..	..	24	5
<i>Horsfieldia subglobosa</i>	16	1	..	..	..	17	3
<i>Zygia jiringa</i> ..	13	1	..	..	..	14	6
<i>Ochanostachys amantacea</i>	11	1	..	..	..	12	5
<i>Eugenia polyantha</i> ..	12	3	..	..	..	15	5
<i>Hopea megarawan</i> ..	8	1	..	..	..	9	4
<i>Elaeocarpus</i> sp. ..	7	1	..	..	..	8	6
<i>Baccaurea parviflora</i> ..	1	3	..	..	..	4	3
<i>Galearia</i> sp. ..	3	1	..	..	..	4	2
<i>Knema hookeriana</i> ..	1	2	..	..	..	3	3
<i>Salacia flavescens</i> ..	2	1	..	..	..	3	3
	239	25	4	1	4	273	

In contrast Group H, Table XII, with a total of 138 species represents plants which are seedlings or saplings of larger plants or rarely, and these are marked with an asterisk, Herbs of the forest floor.

TABLE XII.
GROUP H.

Species	Total	B	Species	Total	B
Actinodaphne pruinosa ..	5	3	Elaeocarpus ferrugineus	1	1
Adinandra dumosa ..	20	5	Elaeocarpus mastersii ..	2	1
Aeschynanthus sp. ..	2	1	Elaeocarpus petiolatus ..	1	1
Aglaia trichostemon ..	1	1	Elaeocarpus stipularis ..	1	1
Aglaia sp. ..	1	1	Elaeocarpus sp. ..	1	1
Aglaonema schottianum			Ellipanthus tomentosus ..	2	1
var. angustifolium* ..	13	3	Eugenia garcinifolia ..	15	2
Alsodeia floribunda ..	1	1	Eugenia grandis ..	1	1
Antidesma alatum ..	7	5	Erycibe maingayi ..	24	6
Aporosa sp. ..	1	1	Ficus callicarpa ..	3	3
Apostasia nuda* ..	3	2	Ficus sp. ..	2	1
Aquilaria hirta ..	1	1	Fissistigma latifolium		
Ardisia teijsmanniana ..	1	1	var. ovoideum ..	9	4
Ardisia spp. ..	21	5	Fissistigma fulgens ..	9	3
Artabotrys costatus ..	1	1	Fordia filipes ..	10	6
Artabotrys susveloens ..	6	3	Galearia phlebocarpa ..	1	1
Arthropphyllum diversi-			Garcinia gaudichaudii ..	2	1
folium ..	1	1	Garcinia mangostana ..	1	1
Artocarpus anisophyllus	4	2	Garcinia sp. ..	1	1
Artocarpus dadah ..	1	1	Glycosmis chlorosperma	38	6
Artocarpus integer ..	4	3	Gnetum macrocarpum ..	2	2
Artocarpus lancifolius ..	11	3	Goniothalamus macro-		
Artocarpus scortechinii	6	7	phyllum ..	1	1
Athyrium cordifolium ..	2	2	Goniothalamus malaya-		
Blumeodendron tokbrai	1	1	nus ..	1	1
Byttneria maingayi ..	2	2	Guioa pubescens ..	1	1
Caladium denudatum ..	2	2	Gymnacantha bancana	1	1
Calamus ornatus var.			Gynotroches axillaris ..	2	2
horridus ..	16	3	Helicia excelsa ..	1	1
Calamus javensis ..	21	6	Homalomena rubra* ..	2	2
Calophyllum sp. ..	29	2	Hoya ridleyi ..	1	1
Canthium horridum ..	5	2	Ilex cymosa ..	1	1
Centotheca latifolia* ..	1	1	Ipomoea maxima ..	1	1
Centrosema sp. ..	1	1	Ixonanthes icosandra ..	8	3
Champereia manillana ..	3	3	Ixora congesta ..	8	5
Chasalia chartacca ..	13	4	Ixora sp. ..	5	3
Chisocheton sp. ..	1	1	Knema communis ..	1	1
Cnestis palala ..	1	1	Knema malayana ..	8	4
Cordyline sp. ..	2	1	Korthalsia sp. ..	2	1
Cratoxylon formosum ..	2	1	Labisia pothoina* ..	16	4
Croton laevifolium ..	1	1	Lasianthus densifolius ..	4	3
Curculigo latifolia* ..	1	1	Lasianthus sp. I ..	12	5
Cyathocalyx ridleyi ..	1	1	Lasianthus sp. II ..	1	1
Cyathostemma viridi-			Lasianthus sp. III ..	1	1
florum ..	5	2	Licuala sp. ..	6	5
Daemonerops sp. ..	21	6	Lindera sp. ..	1	1
Desmos dasymaschalus ..	1	1	Luvunga sarmentosa ..	11	5
Demsos dumosus ..	3	3	Macaranga javanica ..	1	1
Dioscorea pyrifolia ..	2	2	Mangifera sp. ..	2	1
Dipterocarpus sublamel-			Nephelium lappaceum	1	1
latus ..	1	1	Oxymitra calycina ..	9	2
Dracaena granulata ..	1	1	Palaquium obovatum ..	10	3
Dracaena umbratica ..	12	6	Pandanus ornatus ..	2	2
	261			511	

GROUP H—continued

Species	Total	B	Species	Total	B
	511			588	
<i>Parkia speciosa</i> ..	3	3	<i>Sandoricum koetjape</i> ..	4	3
<i>Phaeanthus ophthalmicus</i> ..	1	1	<i>Scleropyrum ridleyi</i> ..	1	1
<i>Philodendron</i> sp. ..	2	1	<i>Shorea</i> sp. No. 4 ..	52	5
<i>Phymatodes scolopendrium</i> * ..	2	2	<i>Sloetia elongata</i> ..	2	1
<i>Abarema elliptica</i> ..	7	5	<i>Smilax calophylla</i> ..	3	2
<i>Plectocomia griffithii</i> ..	4	1	<i>Strombosia rotundifolia</i> ..	5	2
<i>Polyalthia cauliflora</i> ..	8	3	<i>Strychnos ovalifolia</i> ..	15	6
<i>Psychotria helforiana</i> ..	1	1	<i>Strychnos</i> sp. ..	3	1
<i>Psychotria maingayi</i> ..	1	1	<i>Tabernaemontana malaccensis</i> ..	26	6
<i>Psychotria</i> sp. ..	1	1	<i>Urophyllum glabrum</i> ..	6	5
<i>Pternandra</i> sp. ..	1	1	<i>Urophyllum griffithianum</i> ..	1	1
<i>Ptychoraphis singaporeana</i> ..	1	1	<i>Vatica wallichii</i> ..	1	1
<i>Quercus</i> sp. ..	1	1	<i>Vitex pubescens</i> ..	1	1
<i>Randia arisophylla</i> ..	9	4	<i>Vitis gracilis</i> ..	2	2
<i>Randia incurva</i> ..	1	1	<i>Wikstroemia ridleyi</i> ..	1	1
<i>Randia longiflora</i> ..	10	5	<i>Xanthophyllum</i> sp. ..	1	1
<i>Randia macrophylla</i> ..	20	5	<i>Xylopia ferruginea</i> ..	1	1
<i>Raphidiophora</i> sp.* ..	2	2	<i>Zizyphus horsfieldii</i> ..	7	5
<i>Rhodamnia trinervia</i> ..	2	2	Unknowns ..	2	1
	588			722	

TABLE XIII.

DIPTEROCARPACEAE.

DIAMETER CLASSES

Species	0-1	1-3	3-5	5-7	Over 7	Total	B
<i>Shorea macroptera</i> ..	178	..	..	..	3	181	9
<i>Shorea parvifolia</i> ..	172	..	..	..	1	173	7
<i>Shorea parviflora</i> ..	83	..	..	..	..	83	10
<i>Shorea</i> sp. No. 4 ..	52	..	..	..	..	52	5
<i>Anisoptera megistocarpa</i> ..	8	..	..	1	1	10	5
<i>Hopea mengarawan</i> ..	8	1	..	..	..	9	4
<i>Dipterocarpus verrucosus</i> ..	1	..	..	..	1	2	1
<i>Dipterocarpus hasseltii</i> ..	..	..	..	..	1	1	1
<i>Dipterocarpus sublamellatus</i> ..	1	..	..	..	..	1	1
Total ..	504	1	0	1	7	513	..

Table XIII summarises all the data of the family Dipterocarpaceae, totalling 513 records. This total, 513, represents 12 per cent of the total of plants recorded from the transect.

In conclusion the naming of the community gives little difficulty in terms of previous proposals (Gilliland, H. B., 1958). This is a *Shorea/Agrostistachys* community.

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